What is claimed is:

1. A method for separating fluorescent light induced in a material by a light source from elastically scattered/reflected light in a full reflectance spectrum of the material, the light source comprising a spectrum, the method comprising:

comparing the full reflectance spectrum to a residual polarization reflectance spectrum over a nonfluorescing portion of the spectrum, the residual polarization reflectance spectrum comprising substantially no fluorescent light; and

extrapolating a fluorescence spectrum, the fluorescence spectrum representing a spectral dependence of the fluorescent light over the spectrum, from the residual polarization reflectance spectrum and the full reflectance spectrum.

2. The method of Claim 1, the act of comparing further comprising:

measuring a maximum polarization reflectance spectrum;

measuring a minimum polarization reflectance spectrum; and

calculating the residual polarization reflectance spectrum as a difference between the maximum polarization reflectance spectrum and the minimum polarization reflectance spectrum.

3. The method of Claim 1, further comprising fitting the residual polarization reflectance spectrum into the full reflectance spectrum over the nonfluorescing portion of the spectrum to derive a fitted reflectance spectrum representing substantially only the elastically scattered/reflected light over the spectrum.

4. The method of Claim 3, the act of extrapolating comprising calculating the difference between the full reflectance spectrum and the fitted reflectance spectrum to extrapolate the fluorescence spectrum.

5. The method of Claim 4, the method further comprising extracting a magnitude of a peak of the fluorescence spectrum, the magnitude of the peak being a measure of a characteristic of the material; and

extracting a wavelength corresponding to the peak, the wavelength being another measure of a characteristic of the material.

6. The method of Claim 1, wherein the light source is linearly polarized before illuminating the material.

7. The method of Claim 6, wherein the light source is horizontally linearly polarized.

8. The method of Claim 1, wherein the material comprises algae, the method further comprising:

extracting a magnitude of a peak of the fluorescence spectrum, the magnitude being a measure of at least one of chlorophyll concentration and photosynthetic activity.

9. The method of Claim 1, wherein the light source comprises a broadband spectrum.

10. The method of Claim 9, wherein the broadband spectrum is provided by sunlight.

11. The method of Claim 3, the step of fitting further comprising applying multiple regression to calculate the fitted reflectance spectrum.

12. The method of Claim 1, further comprising:

obtaining a laser-induced fluorescence spectrum using a laser light source; and

fitting a function representing the sum of the residual polarization reflectance and the fluorescence spectra into the full reflectance spectrum over the spectrum, the fluorescence spectrum being approximated as a product of a scale factor and the laser-induced fluorescence spectrum, the act of extrapolating further comprising calculating the fluorescence spectrum from the product.

13. The method of Claim 1, wherein the elastically scattered/reflected light comprises Raman backscatter, the method being adapted for use in a Raman lidar system.

14. The method of Claim 1, the method being adapted for use in a sky observation system, the fluorescent light comprising fluorescence emissions in the atmosphere.

15. A method for separating fluorescent light induced in a material by a light source from elastically scattered/reflected light in a full reflectance spectrum of the material, the method comprising:

providing a linearly polarized light source;

measuring a minimum reflectance spectrum including a cross polarized component of the elastically scattered/reflected light; and

extracting a fluorescence spectrum from the minimum reflectance spectrum.

16. The method of Claim 15, the act of extracting further comprising:

multiplying the minimum reflectance spectrum by a scale factor; and

correcting the scaled minimum reflectance spectrum for background.

17. The method of Claim 16, wherein the scale factor is substantially equal to 2.

18. The method of Claim 15, further comprising normalizing the minimum reflectance spectrum to a reflectance standard installed at 45 degrees to the light source in place of the material.

19. The method of Claim 18, wherein the reflectance standard is a Spectralon plate.

20. The method of Claim 15, the act of measuring further comprising rotating a linear polarizer in front of a detector until a minimum light signal is detected, a position of the linear polarizer for minimum light signal representing the cross polarized component.

21. A method for separating unpolarized light from backscattered/reflected light in a full reflectance spectrum of a surface illuminated by a light source, the light source comprising a spectrum, the method comprising:

comparing the full reflectance spectrum to a residual polarization reflectance spectrum over a portion of the spectrum comprising substantially no unpolarized light, the residual polarization reflectance spectrum comprising substantially no unpolarized light; and

extrapolating an unpolarized spectrum of the unpolarized light over the spectrum from the residual polarized reflectance spectrum and the full reflectance spectrum.

22. The method of Claim 21, the act of comparing further comprising:

measuring a maximum polarization reflectance spectrum;

measuring a minimum polarization reflectance spectrum; and

calculating the residual polarization reflectance spectrum as a difference between the maximum polarization reflectance spectrum and the minimum polarization reflectance spectrum.

23. The method of Claim 21, further comprising fitting the residual polarization reflectance spectrum into the full reflectance spectrum over the portion of the spectrum to derive a fitted reflectance spectrum representing substantially only the elastically scattered/reflected light over the spectrum.

24. The method of Claim 23, the act of extrapolating comprising calculating the difference between the full reflectance spectrum and the fitted reflectance spectrum to extrapolate the unpolarized spectrum.

25. The method of Claim 23, the act of fitting further comprising applying multiple regression to calculate the fitted reflectance spectrum.

26. The method of Claim 21, wherein the light source is linearly polarized before illuminating the material.

27. The method of Claim 26, wherein the light source is horizontally linearly polarized.

28. The method of Claim 21, wherein the light source comprises a broadband spectrum.

29. The method of Claim 28, wherein the broadband spectrum is provided by sunlight.

30. The method of Claim 29, the method being adapted for separation of thermal radiation from solar illumination,

wherein the unpolarized light comprises thermal radiation, and further wherein the polarized light represents backscattered/reflected solar illumination.

31. An apparatus for separating unpolarized light induced in a material by a light source from elastically scattered/reflected polarized light in a full reflectance spectrum of the material, comprising:

a detector, the detector comprising an axis of detection, a scattering angle being measured between a direction of illuminating light from the light source to the material and the axis of detection;

a spectrometer, the spectrometer and detector being used to measure at least the full reflectance spectrum; and

an analyzing polarizer, at least one of a minimum detected polarization reflectance spectrum and a residual polarization reflectance spectrum being measured by the spectrometer and detector by adjusting the analyzing polarizer, wherein

a spectrum of the unpolarized light is extrapolated from the at least one of the minimum detected polarization reflectance spectrum and the residual polarization reflectance spectrum.

32. The apparatus of Claim 31, wherein the analyzing polarizer is sequentially adjusted to measure each of the minimum detected polarization reflectance spectrum and a maximum detected polarization reflectance spectrum, the residual polarization reflectance spectrum being calculated as a difference between the measured minimum and maximum detected polarization reflectance spectra.

33. The apparatus of Claim 31, further comprising a linear source polarizer after the light source, the linear source polarizer providing linearly polarized illuminating light to the material.

34. The apparatus of Claim 31, wherein the illuminating light is provided by a broadband source.

35. The apparatus of Claim 34, wherein the illuminating light comprises sunlight.

36. The apparatus of Claim 31, wherein the unpolarized light comprises fluorescent light.

37. The apparatus of Claim 31, adapted for use in a Raman lidar system, the elastically scattered/reflected polarized light comprising Raman backscatter.

38. The apparatus of Claim 36, adapted for use in a sky observation system, the fluorescent light comprising fluorescence emissions in the atmosphere.

39. The apparatus of Claim 31, further comprising a collimator, the collimator providing collimated illuminating light to the material.

40. The apparatus of Claim 31, wherein the analyzing polarizer comprises one of a rotatable linear polarizer and a polarizing prism.

41. The apparatus of Claim 31, wherein the scattering angle is substantially equal to ninety degrees.

42. The apparatus of Claim 31, further comprising collection optics coupled to the spectrometer, the collection optics comprising a fiber optic probe.

43. The apparatus of Claim 31, being adapted for separation of thermal radiation from solar illumination, the unpolarized light comprising thermal radiation, and the elastically scattered/reflected polarized light comprising backscattered/reflected solar illumination.

44. The apparatus of Claim 36, wherein the material comprises algae, a magnitude of a peak of the fluorescent spectra corresponding to at least one of chlorophyll concentration and photosynthetic activity.

45. An apparatus for separating fluorescent light from light elastically scattered/reflected from a material illuminated with a broadband illumination source comprising:

a polarization discriminator, the polarization discriminator separating the elastically scattered/reflected light from the fluorescent light, the fluorescent light being substantially unpolarized, the elastically scattered/reflected light being substantially polarized; and

a spectrometer, the spectrometer spectrally analyzing the fluorescent light and the elastically scattered/reflected light.

46. The apparatus of Claim 45, further comprising:

a linear polarizer, the linear polarizer polarizing the broadband illumination source.

47. A method for separating fluorescence light induced in a material by broadband light from an elastic scattering/reflection component of the broadband light, comprising:

providing polarization discrimination to separate the fluorescence light from the elastic scattering/reflection component, the fluorescence light being substantially unpolarized and the elastic scattering/reflection component being at least partially polarized; and

spectrally analyzing the fluorescence light and the elastic scattering/reflection component.

48. The method of Claim 47, further comprising linearly polarizing the broadband light.

49. The method of Claim 10, the method being adapted for use with environmental remote sensing, further comprising calculating chlorophyll fluorescence of vegetation from the fluorescence spectrum.

50. The method of Claim 1, the method being adapted for use in medical diagnostics, the material comprising one of a specimen, a living tissue, and a bodily material, said method further including diagnosing a medical condition from the fluorescence spectrum.

51. The apparatus of Claim 36, adapted for use in an environmental remote sensor, the spectrum of the fluorescent light being used to calculate chlorophyll fluorescence of vegetation.

52. The apparatus of Claim 36, adapted for use in a medical diagnostic system, the spectrum of the fluorescent light being used to diagnose a medical condition.